

- 11 -

We claim:

1. A packaged semiconductor die, comprising:
a substrate having a first major surface, a second major surface opposed to the
5 first major surface, and a substrate edge extending between the first and second major
surfaces, wherein the semiconductor die is mounted to the first major surface of the
substrate; and
an elongated rib that extends along at least a portion of the second major surface
and which projects outwardly from the second major surface.
10
2. The packaged semiconductor die of claim 1, further comprising at least one
bond pad situated on the second major surface.
3. The packaged semiconductor die of claim 1, further comprising:
15 at least one solder bump projecting from the second major surface of the
substrate.
4. The packaged semiconductor die of claim 1, wherein the rib extends along at
least a portion of a perimeter of the second major surface.
20
5. The packaged semiconductor die of claim 1, wherein the rib is positioned to
encapsulate at least a portion of the substrate edge.
6. The packaged semiconductor die of claim 5, further comprising a package
25 cover that encapsulates at least a portion of a perimeter of the first major surface of the
substrate.

- 12 -

7. The packaged semiconductor die of claim 1, further comprising a package cover that at least partially encapsulates the semiconductor die and at least a portion of a perimeter of the first major surface of the substrate.

5 8. The packaged semiconductor die of claim 1, further comprising a package cover that encapsulates the semiconductor die and at least a portion of a perimeter of the first major surface of the substrate.

 9. The packaged semiconductor die of claim 8, further comprising at least one
10 interconnect that electrically connects the semiconductor die to the substrate, and wherein the interconnect is encapsulated by the package cover.

 10. The packaged semiconductor die of claim 9, further comprising:
 at least one solder bump projecting from the second major surface of the
15 substrate.

 11. An integrated circuit assembly, comprising:
 a semiconductor die;
 a substrate to which the semiconductor die is attached and electrically
20 connected;
 a circuit board;
 solder bumps that electrically connect the circuit board to the substrate; and
 a package cover that encapsulates the die, at least a portion of an edge of the
 substrate, and includes a rib that extends into contact with the circuit board.

25 12. A packaged die, comprising:
 a substrate having a first major surface to which the die is attached and a second major surface opposed to the first major surface; and

- 13 -

a frame projecting outwardly from the second major surface, the frame surrounding a cavity bounded by the frame and the second major surface.

13. The packaged die of claim 12, further comprising a package cover that
5 encapsulates the die.

14. The packaged die of claim 13, wherein the substrate has an edge extending between the first and second major surfaces, and wherein the frame encapsulates at least a majority of the edge of the substrate.
10

15. The packaged die of claim 12 including a plurality of separated solder bumps coupled to the second major surface and positioned within the frame.

16. The packaged die of claim 15 including encapsulant occupying the cavity
15 between the solder bumps.

17. A package for a die that is mounted to a substrate, comprising an elongated rib situated to extend from a surface of the substrate and to encapsulate at least a portion of an edge of the substrate.
20

18. The package of claim 17, further comprising a package cover situated to encapsulate the die, the package cover being connected to the rib.

19. The package of claim 18, wherein the rib and the package cover are of a
25 unitary one-piece integral construction.

20. A mold for molding a package for at least one die bonded to a substrate, the mold defining a package cover for encapsulating the die and a portion of a surface of

- 14 -

the substrate to which the die is bonded, and a rib that extends from a surface of the substrate.

21. The mold of claim 20, comprising first and second mold sections, the first
5 and second mold sections defining the package cover and the rib so that at least a
portion of the substrate edge is encapsulated by either the package cover or the rib, or
both the package cover and the rib.

22. The mold set of claim 21, wherein the upper mold and the lower mold
10 define package covers and ribs for a plurality of die bonded to the substrate.

23. A method of reducing moisture penetration into a circuit assembly, the
circuit assembly including a substrate attached to a circuit board, comprising:
covering at least a portion of an edge of the substrate with an encapsulant; and
15 forming a rib that covers at least a portion of a first surface of the substrate and
extends from a second surface of the substrate and contacts the circuit board.

24. The method of claim 23, wherein the circuit assembly includes a die and
further comprising covering the die with the encapsulant.
20

25. The method of claim 23, wherein the rib is formed of the encapsulant.

26. A method of soldering a substrate provided with solder bumps to a circuit
board, the method comprising:

25 contacting the circuit board with the solder bumps;
heating the solder bumps so that the solder bumps reflow to connect to the
circuit board; and
providing a rib situated to maintain a separation between the substrate and the
circuit board as the solder bumps reflow.

- 15 -

27. The method of claim 26, wherein the rib is provided at at least a portion of a perimeter of the substrate.

5 28. The method of claim 26, wherein the solder bumps are heated so that the rib contacts the circuit board and acts as a stop.

29. The method of claim 28, further comprising bonding the rib to the circuit board.

10

30. The method of claim 28, further comprising bonding the rib to the substrate.

31. The method of claim 30, further comprising bonding the rib to the circuit board.

15

32. The method of claim 26, further comprising encapsulating at least a portion of an edge of the substrate with the rib.

20

33. A method of packaging a die, comprising:
bonding the die to a first surface of a substrate;
attaching one or more solder bumps to a second surface of the substrate; and
providing an encapsulating layer that encapsulates the die and includes a rib that encapsulates at least a perimeter portion of the second surface of the substrate.

25

34. The method of claim 33, wherein the encapsulating layer encapsulates at least a portion of the first surface of the substrate.

35. The method of claim 34, further comprising defining the rib with a mold.

- 16 -

36. The method of claim 33, wherein the rib has a thickness that is at least as large as a thickness of the solder bumps.

37. A method of attaching a substrate to a circuit board, comprising:
5 providing a rib that covers a perimeter portion of a surface of a substrate; and
electrically connecting the substrate to the circuit board so that the separation of
the substrate and the circuit board is defined by the rib.

38. A method for attaching a ball grid array packaged die to a circuit board,
10 comprising:
providing a support band extending along at least a portion of a perimeter of a
surface of the ball grid array packaged die; and
heating the packaged device to reflow solder balls provided at the surface of the
ball grid array packaged die.

15 39. A method of making a package for a die mounted to a substrate,
comprising:
contacting a first surface of the substrate with a first mold;
contacting the first mold with a second mold; and
20 injecting an encapsulant into a cavity defined by the first mold and the second
mold, wherein one of the first mold and the second mold define a cavity for a rib.